

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
25 March 2004 (25.03.2004)

PCT

(10) International Publication Number  
**WO 2004/025671 A3**

(51) International Patent Classification<sup>7</sup>: H01F 5/00, 27/24

(21) International Application Number:  
PCT/US2003/029053

(22) International Filing Date:  
15 September 2003 (15.09.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/411,801 16 September 2002 (16.09.2002) US

(71) Applicant (for all designated States except US): M-FLEX  
MULTI-FINELINE ELECTRONIX, INC. [US/US];  
3140-A East Coronado Street, Anaheim, CA 92806 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): HARDING, Philip, A.  
[US/US]; 29443 Stonecrest Road, Palos Verdes, CA 90275  
(US).

(74) Agent: DELANEY, Karoline, A.; Knobbe, Martens, Ol-  
son and Bear, LLP, 2040 Main Street, Fourteenth Floor,  
Irvine, CA 92614 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT (util-  
ity model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA,  
CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (util-  
ity model), DE, DK (utility model), DK, DM, DZ, EC, EE  
(utility model), EE, ES, FI (utility model), FI, GB, GD, GE,  
GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ,  
LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN,  
MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO,  
RU, SC, SD, SE, SG, SK (utility model), SK, SL, SY, TJ,  
TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA,  
ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,  
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,  
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,  
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

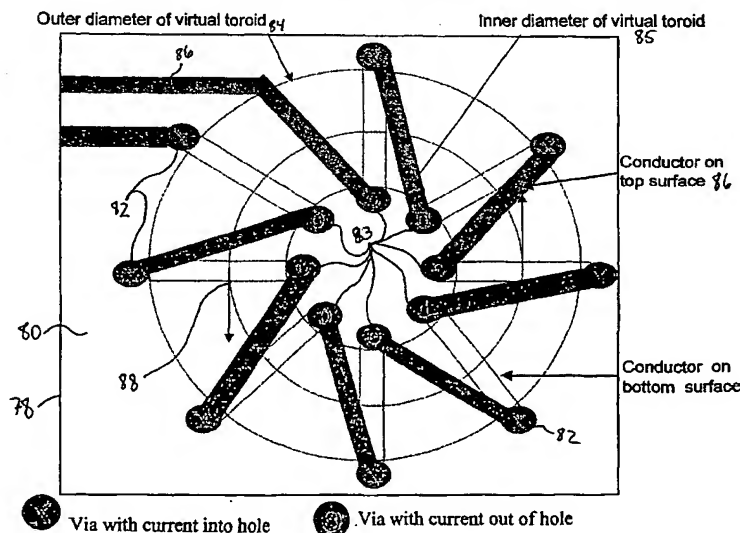
— with international search report

(88) Date of publication of the international search report:  
10 June 2004

[Continued on next page]

(54) Title: ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND METHODS FOR MAKING SAME

A virtual toroid core energized by an 8 turn winding



(57) Abstract: The present invention relates to transformer inductor devices and to the methods of construction for inductive components such as inductors, chokes, and transformers. Plural via holes 12 are formed through a ferromagnetic substrate 10. Primary 32 and secondary 34 conductors are placed through common vias to form a plurality of cell transformers having a 1:1 turns ratio. Circuits connect these primary and secondary winding in parallel and serial combustion to provide a transformer having the desired turns ratio.

WO 2004/025671 A3

WO 2004/025671 A3



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US03/29053**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : H01F 5/00, 27/24

US CL : 336/200, 212, 223, 232, 83, 178; 29/602.1, 606

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 336/200, 212, 223, 232, 83, 178; 29/602.1, 606

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST: DERWENT, US, EPO, JPO, PG-PUB; Search terms: transformer yoke, transformer leg, magnetic field, primary and secondary winding, PCB, via hole connection

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,996,214 A [BELL] 07 December 1999, whole document	1-11
A	US 4,622,627 A [RODRIGUEZ et al.] 11 November 1986, whole document	1-11
A	US 4,547,705 A [HIRAYAMA et al.] 15 October 1985, whole document	1-11
A	US 6,593,836 B1 [LAFLEUR et al.] 15 July 2003, whole document	1-11
A	JP 363228604 A [ISHIYAMA et al.] 22 September 1988, abstract	1-11
A	US 4,901,048 A [WILLIAMSON] 13 February 1990, whole document	1-11

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier document published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

12 NOVEMBER 2003

Date of mailing of the international search report

18 MAR 2004

Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

ANH MAI

Telephone No. (703) 308-2900

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US03/29053

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,222,733 B1 [GAMMENTHALER] 24 April 2001, whole document	1-11
A	US 6,211,767 B1 [JITARU] 03 April 2001, whole document	1-11